

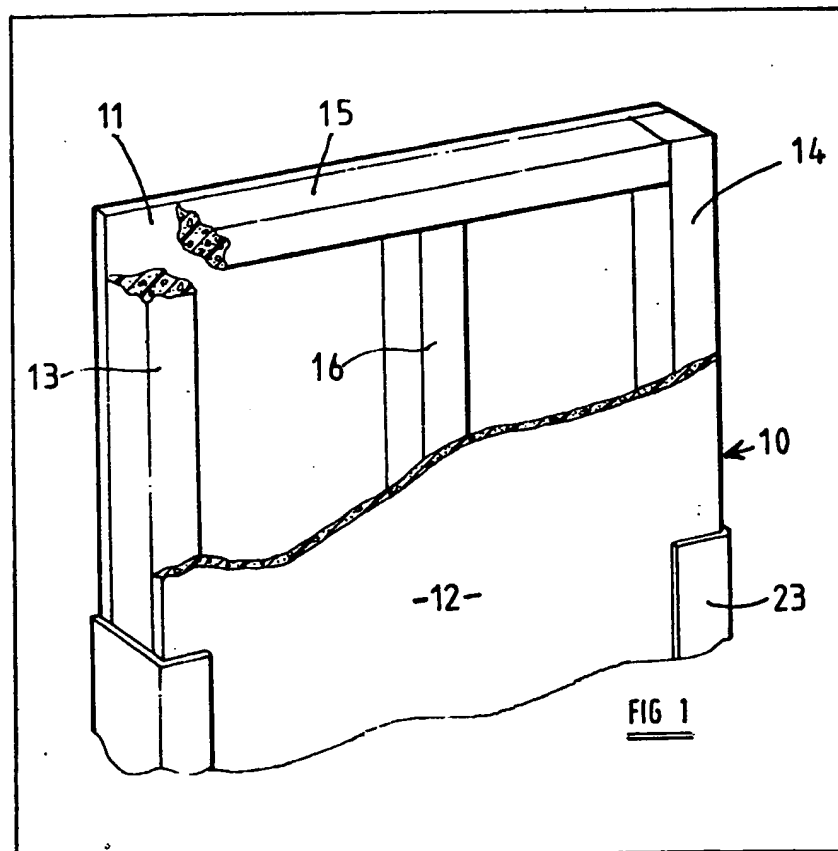
(12) UK Patent Application (19) GB (11) 2 129 475 A

- (21) Application No 8328704
- (22) Date of filing 27 Oct 1983
- (30) Priority data
- (31) 8231551
- (32) 4 Nov 1982
- (33) United Kingdom (GB)
- (43) Application published 16 May 1984
- (51) INT CL³
E06B 5/16
- (52) Domestic classification
E1J GL
- (56) Documents cited
GBA 2102869
GBA 2056535
GB 1601948
GB 1430818
- (58) Field of search
E1J
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(54) Fire door made of g.r.c. only

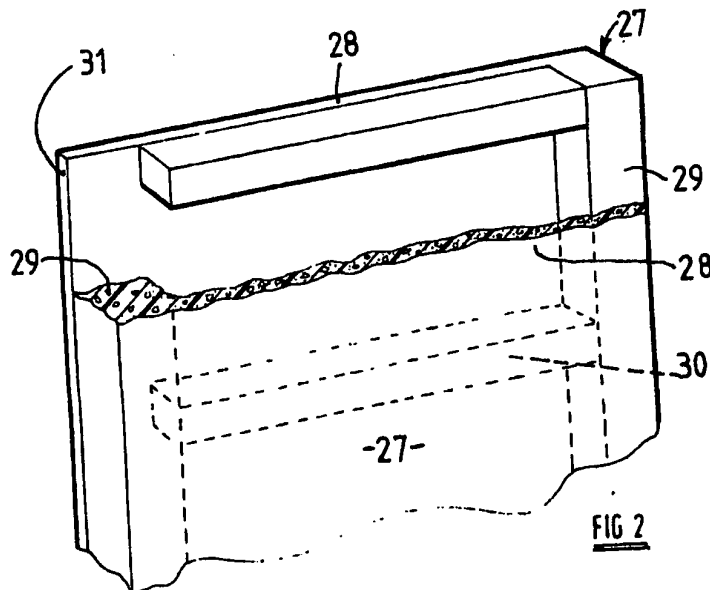
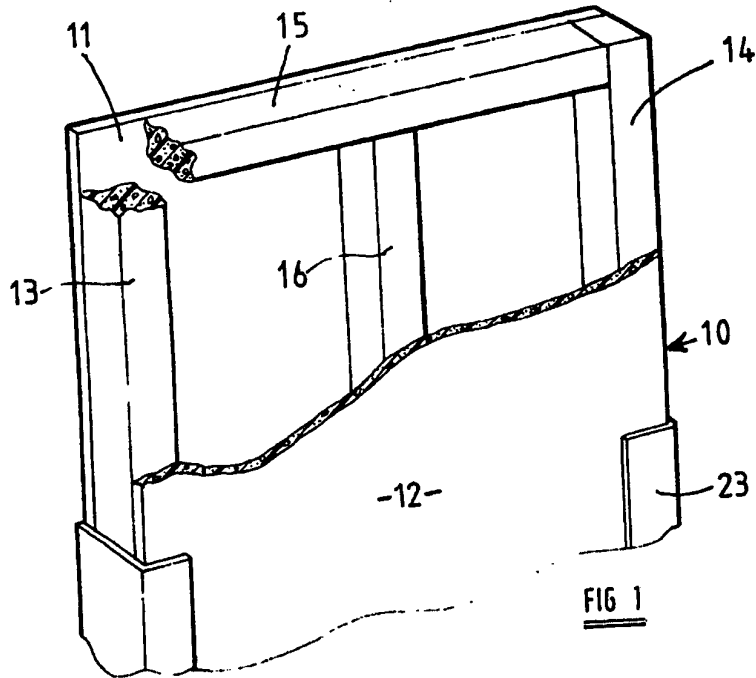
(57) A fire door (10), intended to meet the requirements for a ship's cabin door for example, is made entirely of glass-fibre reinforced cement (grc). The door (10) is hollow, and three constructional methods are described. In the first (Figure 1), a framework (13, 14, 15, 16) of grc is clad with plane grc facing sheets (12), which may be of a type having high density

faces and a low density core. In a second form (Figure 2), the facing sheets (28) have integral edge ribs (27, 29) and are adhesively secured back-to-back, leaving an internal hollow. In a third form (Figure 3), generally diagonally positioned ribs (32) on the facing sheets cross at crossing points (33) where they are secured together. The internal compartments or baffles within the hollow door reduce convection in the event of a fire.



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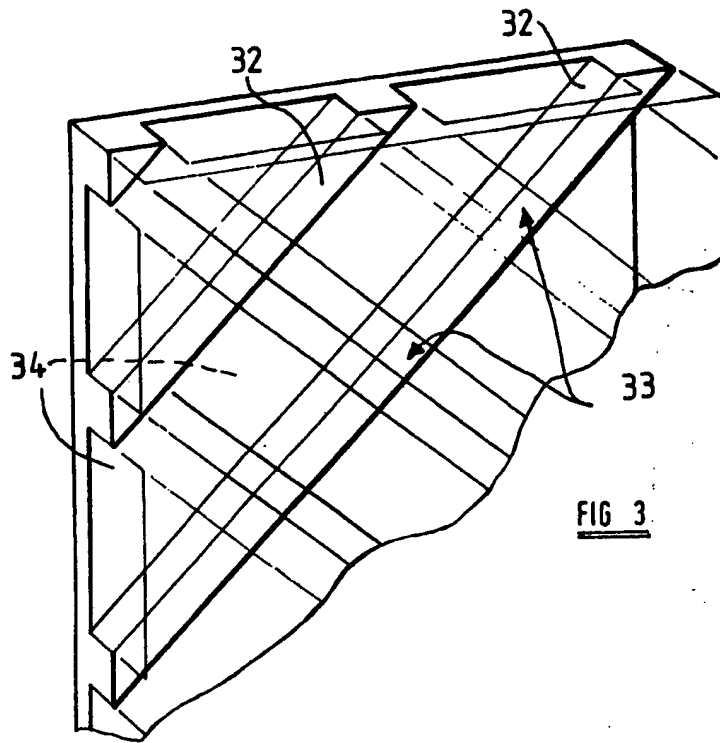


FIG 3

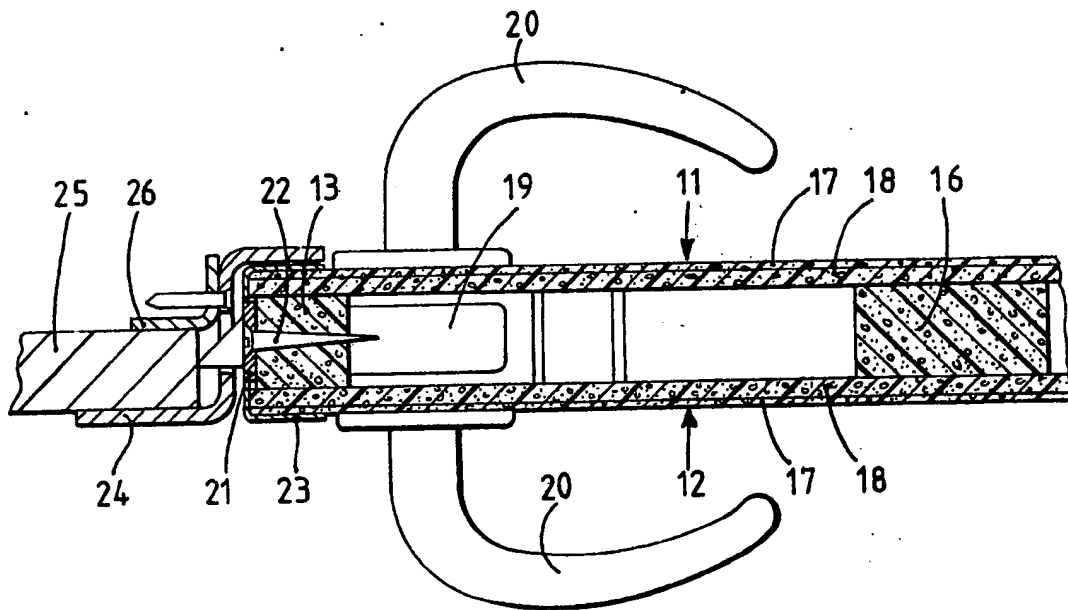


FIG 4

SPECIFICATION Fire door

This invention relates to fire doors and similar barriers, such as partitions, where the context allows.

Particularly stringent fire regulations are applied in the fitting out of ships and offshore installations. In a typical arrangement, a U.K.-registered ship is required to have main internal bulkheads and doors constructed to "A" class specifications of the Department of Trade and Industry, while cabin doors are required to meet slightly less stringent "B" class specifications.

The "A" and "B" class specifications deal with three main areas of fire protection, namely:-
(1) Stability, i.e. resistance to collapse,
(2) Integrity, i.e. resistance to leakage of hot gases or flame;
(3) Insulation.

Tests are carried out on a fire door mounted in a standard partition and subjected to standard furnace heat, to assess the times during which protection is given under each of these headings (1) to (3). A classification is given to the fire door construction accordingly. Conventional "B" class fire doors are made of a mild steel framework and packed internally with a non-combustible insulating material such as mineral wool.

Such doors are relatively heavy, but substantial weight reduction is not possible without making the door prone to warping and hence reduction in the integrity rating (2). Further, the mild steel sheeting is prone to rusting and is unattractive in appearance so it requires some form of protective and/or decorative facing to be added, for example a melamine laminate.

It is an object of the invention to provide a fire door which overcomes or reduces some or all of these disadvantages.

According to the invention, there is provided a fire door which consists solely of glass-fibre reinforced cement, except for fittings and means of attachment.

By "fittings and means of attachment", we mean door furniture such as latches and handles, hinges and edging strips. It will be appreciated that the addition of a decorative facing or coating of a material other than glass-fibre reinforced cement to the fire door does not remove it from the scope of the invention.

Glass-fibre reinforced cement will be abbreviated to "grc" in the following description, in accordance with conventional practice.

The fire door may be hollow. It may include a plurality of separate internal compartments or internal baffles to reduce convection of gases within the hollow door.

The fire door may have a pair of facing panels of grc. These may each include a dense outer layer and a less dense inner layer.

In a first form of construction, the fire door comprises a framework of elongate grc members to which said facing sheets are secured, for example by adhesive. The framework may include

one or more internal dividers, which may be horizontal or vertical in use.

In a second form of construction, each facing panel may have an elongate rib integrally formed along one of its edges which will be upright in use, the two panels being secured together back-to-back, whereby the ribs form upright elements of a framework of the fire door.

In a third form of construction, each facing panel may have a plurality of elongate ribs integrally formed thereon and lying at an oblique angle to the vertical in use. In this case, when the two facing panels are secured together back-to-back, the ribs cross at a plurality of junction points. The ribs may be secured together at these junction points by adhesive for example.

Three embodiments of fire door according to the invention will now be described in more detail by way of example only, with reference to the accompanying drawings, in which:-

FIGURE 1 is a partial perspective view of a first form of fire door embodying the invention, with the facing shown broken away;

FIGURE 2 is a similar view of a second embodiment of fire door;

FIGURE 3 is a diagrammatic partial view of a third embodiment of fire door;

FIGURE 4 is a detail horizontal sectional view of a fire door and its surround, showing the fitment of a lever latch.

Referring firstly to Figure 1, the fire door shown is generally indicated at 10 and comprises a pair of facing sheets 11 and 12 of grc, mounted on a framework comprised of a pair of grc uprights 13, 14, and transverse top and bottom members, also of grc, of which the top member is shown at 15. The framework also comprises a central upright member 16 of grc, to give additional support.

The framework members 13, 14, 15 and 16 are each of rectangular cross-section. Suitable dimensions have been found to be 26 x 40 mm., but these may be varied to suit particular requirements.

The facing sheets 11 and 12 may be made of a single density grc but it is preferred that they are made with a relatively dense outer layer, best seen at 17 in Figure 4, and a less dense inner layer 18, for example made by the method described in our British Patent number 2,055,682. This gives the outer face of the door a dense surface resistant to damage by fire or otherwise, while permitting the weight of the whole door to be kept to a minimum.

A suitable density for the inner layer 18 is 1.0 to 1.1 tonnes per cubic metre and for the outer layer 17 is in the region of 1.7 tonnes per cubic metre. The outer layer 17 is about 2 mm. thick and the inner layer 18 is about 5 mm. thick. These dimensions and densities may be changed to suit particular requirements. Such a material is marketed under the Trade Mark VELMAC by Tarmac Industrial Holdings Limited.

The framework is secured together by a suitable adhesive and the facing sheets 11 and 12 are also secured to it by adhesive. The adhesive should be fire-resistant, preferably inorganic and

may be for example a filled solution of sodium silicate or potassium silicate. The door structure consists entirely of grc and requires no internal insulation by mineral fibre, though the addition of mineral or other inorganic fibre may enhance the insulation performance and improve the rating of the door.

The door is fitted with the usual fitments and means of attachment for use in a partition, for example hinges and a latch. Figure 4 shows a latch 19 secured within the door, the facing sheets being drilled to receive the handles 20. A forend 21 is screwed at 22 into the upright 13. The edge of the door is trimmed with a stainless steel channel 23 which should, however, be of a material compatible in expansion coefficient with the seating against which the door closes, for most effective fire protection.

In the example illustrated in Figure 4, the door is seated against a generally Z-shaped mild steel frame 24, which surrounds all sides of the door, to provide a good seal. This sealing against flame or hot gases which might otherwise penetrate past the door is an important factor in achieving the desired rating for the integrity (2) of the door in a fire test.

To reduce the tendency for the frame 24 and edging channel 23 to separate during a fire, the materials from which they are made are selected to have comparable thermal expansion coefficients. As an alternative, a mild steel insert can be inserted inside the stainless steel channel to "balance" the behaviour of the door edge and the frame 24 during a fire.

The door 10 is fitted with suitable hinges, not shown. To provide an attractive appearance for the door, the facing sheets 11 and 12 may be painted or covered with a decorative finish, such as melamine laminate. This can be laminated directly onto the sheets 11 and 12 of grc, which gives long-term durability of the finish.

The bulkhead 25 does not form any part of the present invention. It may be of any standard type or thickness having a suitable fire rating. To allow for differences in thickness between different types of bulkhead, the frame is secured to the bulkhead by an auxiliary angle section 26, which will be positioned as shown when the bulkhead is relatively thin, but will be reversed top to bottom from the position shown in the drawing, where the bulkhead is thicker.

Turning to the alternative methods of construction illustrated in Figures 2 and 3, these incorporate profiled grc sheets. In Figure 2, the sheets 27 are of shallow L-shape in cross-section, comprising a flat facing part 28 and an elongate side rib 29. Two or these profiled sheets 27 are arranged back-to-back to form a hollow tubular structure. The top and bottom edges are closed off by transverse grc members 15, similar to those of Figure 1. The hollow interior may have supporting members 30 of grc arranged horizontally as shown or may have a central upright member like that shown at 16 in Figure 1. One advantage of using horizontal supporting members 30 is that

there is a reduction of the amount of convection of hot gases inside the hollow door, which may assist the insulation properties. For this reason, horizontal supporting members may be used in the door construction of Figure 1 instead of members 16.

The profiled sheets 27 may be cut to size at the edge 31 which is not provided with a side rib 29, to fit the door frame dimensions.

Again, the door assembly is secured together with adhesive and may be provided with the same sort of fitments as those described in relation to the Figure 1 embodiment.

Figure 3 diagrammatically illustrates another form of construction using profiled sheets 31 of grc. These sheets have oblique or generally diagonally-positioned ribs 32, for example positioned at 45° to the vertical, and covering the whole surface of the sheet. When two such sheets 31 are placed back-to-back, the diagonal ribs 32 cross at a plurality of crossing points 33, where they can be adhesively secured together. The resulting door structure has an internally pocketed formation, with the ribs 32 forming baffles tending to reduce the internal convection of gases. The pockets can be seen at 34. Edge members of grc can be added to the structure, or its open edges can be covered by a stainless steel channel similar to the channel 23. The usual door fitments will be added.

In both the embodiments of Figures 2 and 3, the grc material of the profiled sheets is of uniform density throughout. This may impose some weight penalty, compared with the constructional method of Figure 1, but the pocketed structure of Figure 3 in particular may have greater strength and rigidity as a result of its construction which may enable the thickness of the facing parts and/or the size of the diagonal ribs to be reduced to avoid excessive weight.

Although the fire doors described are intended to meet the requirements for "B" class doors for use in ships' cabins for example, an all-grc construction may be capable of meeting more stringent requirements.

The invention provides a fire door of relatively low weight compared with a conventional fire door of metal and mineral wool construction. It has a good appearance which can be retained in the long term with little or no maintenance, since it is not prone to corrosion. The door also contains no asbestos, which is a known health hazard.

CLAIMS

1. A fire door (as herein defined) which consists solely of glass-fibre reinforced cement, except for fittings and means of attachment as herein defined.

2. A fire door according to Claim 1 which is hollow.

3. A fire door according to Claim 2 including a plurality of separate internal compartments.

4. A fire door according to Claim 2 or Claim 3 including a plurality of internal baffles.

5. A fire door according to any preceding Claim and having at least one facing panel of glass-fibre reinforced cement.
6. A fire door according to Claim 5 wherein the or each facing panel includes a dense outer layer and a less dense inner layer.
7. A fire door according to Claim 5 or Claim 6, and comprising a framework of elongate grc members to which said facing sheet or sheets is or are secured.
8. A fire door according to Claim 7 wherein the or each facing sheet is secured to the framework by adhesive.
9. A fire door according to Claim 7 or Claim 8 wherein the framework includes one or more internal dividers.
10. A fire door according to Claim 9 wherein the internal dividers are horizontal in use.
11. A fire door according to Claim 9 wherein the internal dividers are vertical in use.
12. A fire door according to any one of Claims 1 to 6 wherein a facing panel has an elongate rib integrally formed along one or more of its edges which will be upright in use.
13. A fire door according to Claim 12 wherein two panels having ribs are provided, the panels being secured together back-to-back, whereby the ribs form upright elements of a framework of the fire door.
14. A fire door according to any one of Claims 1 to 6, wherein a pair of facing panels are provided, each having a plurality of elongate ribs integrally formed thereon and lying at an oblique angle to the vertical in use.
15. A fire door according to Claim 14 wherein the two facing panels are secured together back-to-back, the ribs crossing at a plurality of junction points.
16. A fire door according to Claim 15 wherein the ribs are secured together at these junction points by adhesive.
17. A fire door according to any Claim directly or indirectly dependent on Claim 8 or Claim 16 wherein the adhesive comprises sodium or potassium silicate.
18. A fire door substantially as hereinbefore described with reference to, and as illustrated in Figure 1 of the accompanying drawings.
19. A fire door substantially as hereinbefore described with reference to, and as illustrated in Figure 2 of the accompanying drawings.
20. A fire door substantially as hereinbefore described with reference to, and as illustrated in Figure 3 of the accompanying drawings.
21. A fire door substantially as hereinbefore described with reference to, and as illustrated in Figure 1 or Figure 2 or Figure 3 of the accompanying drawings, as modified by Figure 4.